

FIG. 1

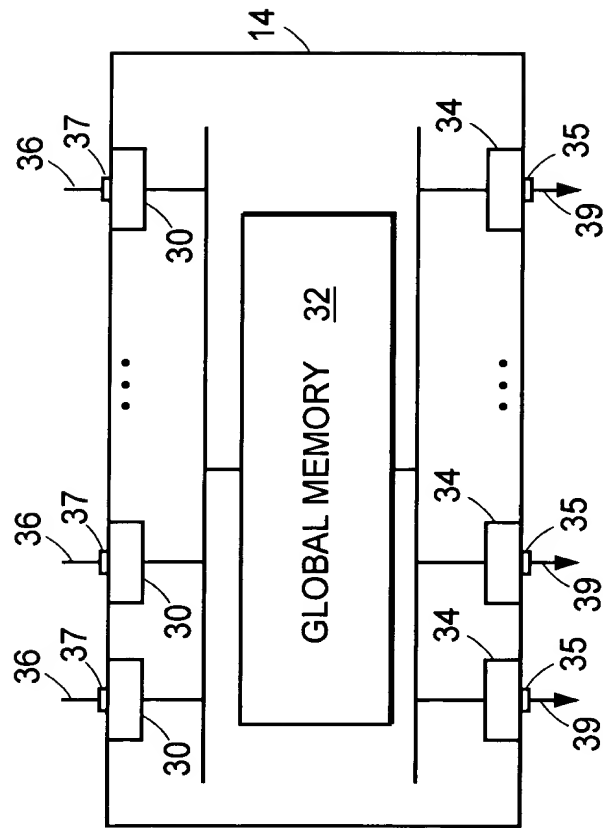


FIG. 2

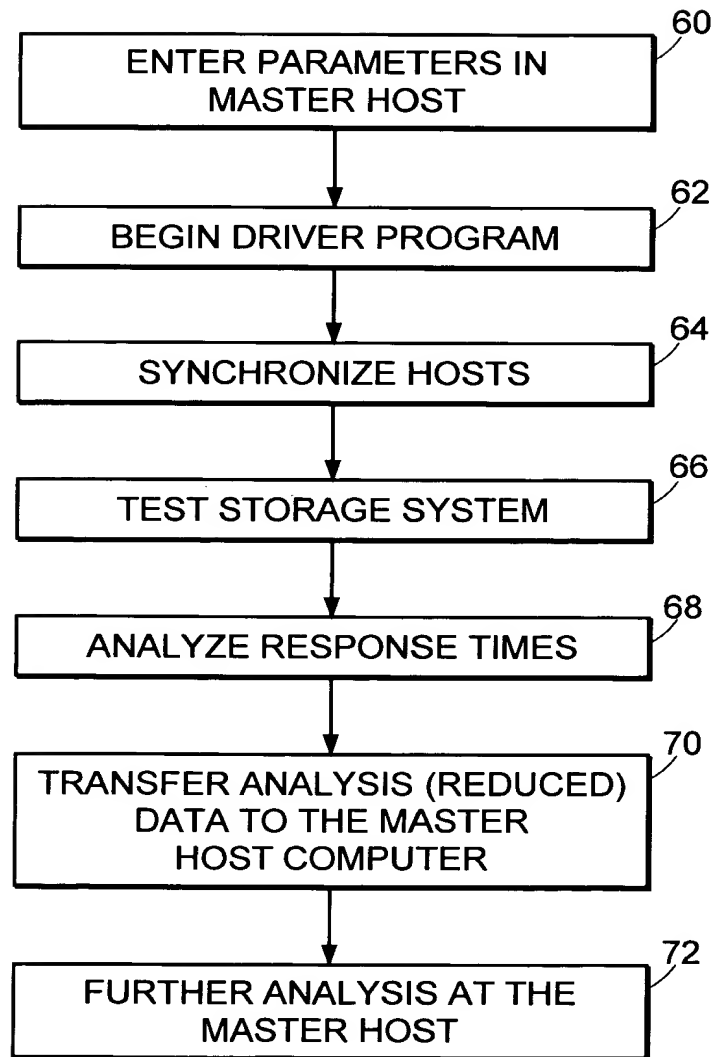


FIG. 3

FIG. 4A
FIG. 4B

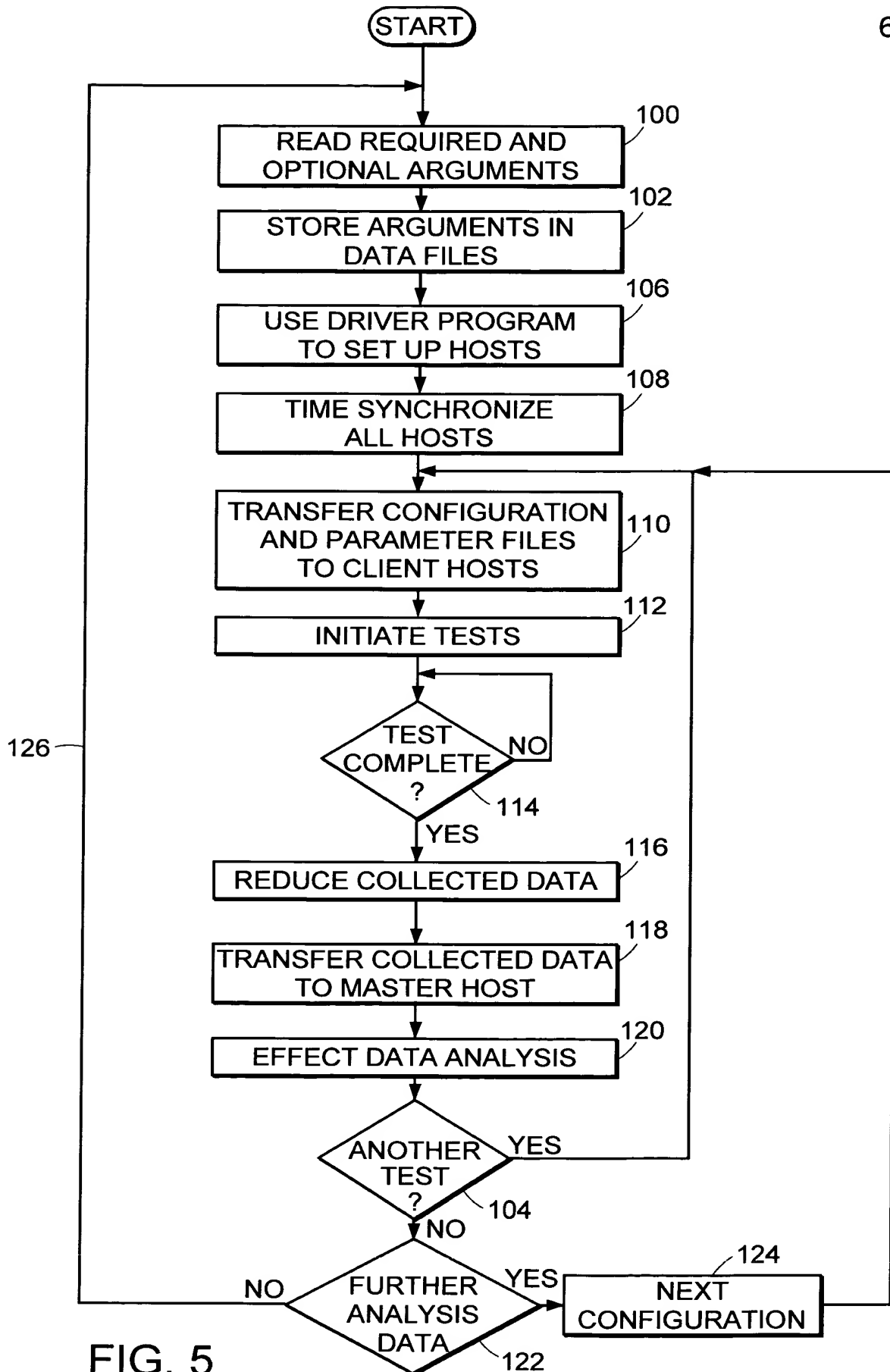
FIG. 4

REQUIRED	NUMBER OF LOGICAL DISKS
	NUMBER OF "CHILD" PROCESSES TO START
	NUMBER OF CAPTURE RESPONSE TIMES
	NUMBER OF RESPONSE TIMES
	BUFFER SIZE
	OFFSET SIZE
	MAXIMUM RANGE
	TIME OF TEST
	READ/WRITE SIZE
	READ/WRITE MIX

FIG. 4A

OPTIONAL	ID OF DEVICES BEING TESTED
	ID OF MASTER & CLIENT HOSTS
	I/O TYPE (SEQUENTIAL OR RANDOM)
	NUMBER OF I/O OPERATIONS PERFORMED TO CORRECT OFFSET
	DISPLACEMENT FROM OFFSET
	DELAY BETWEEN COMMANDS
	INITIAL BYTE OFFSET
	NUMBER OF SEEKS FOR RANDOM I/O
	DATA REDUCTION METHOD
	ICDA PERCENT HIT RATE

FIG. 4B



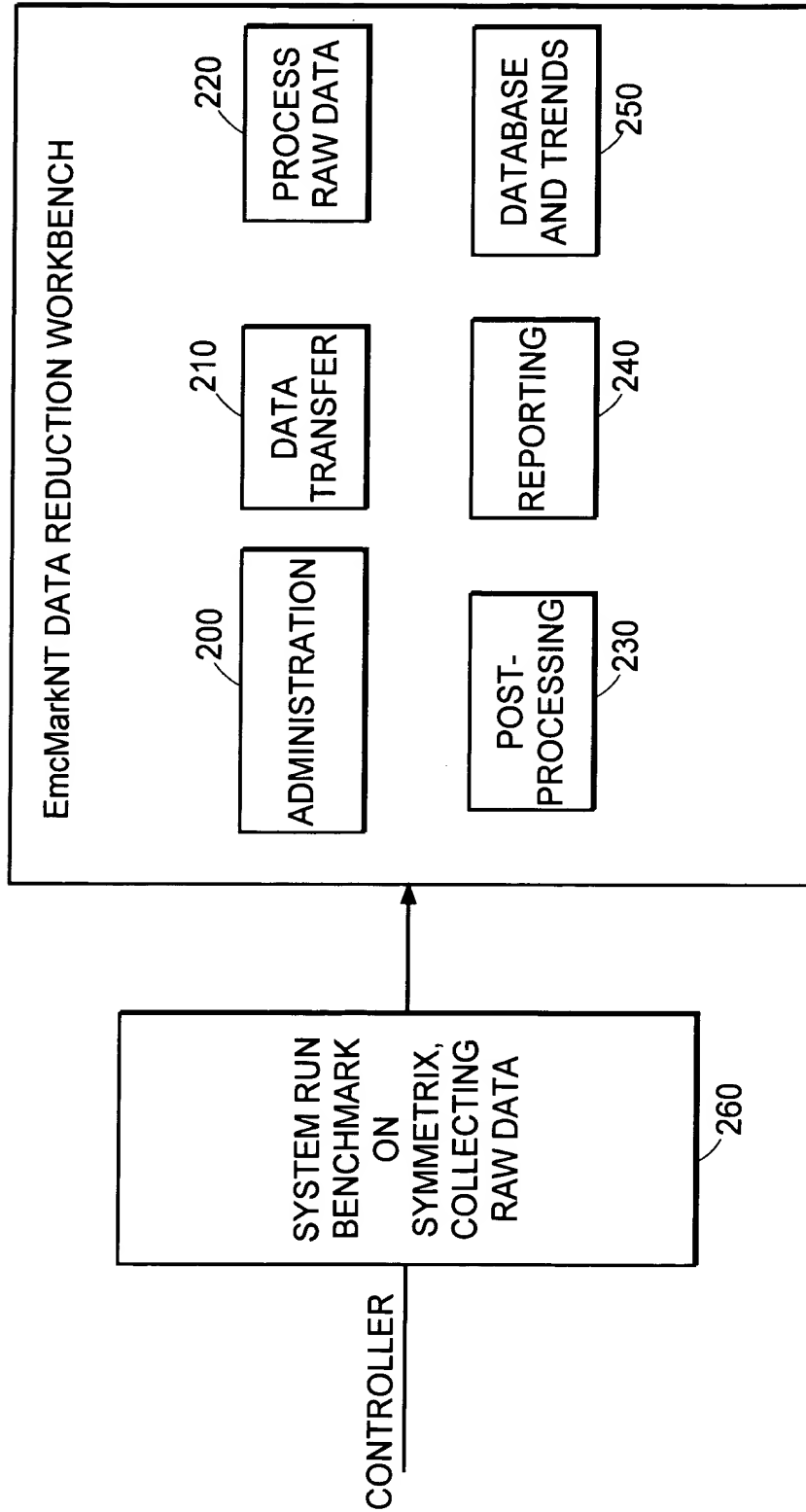


FIG. 6

# EmcMarkNT DATA REDUCTION WORKBENCH FLOW

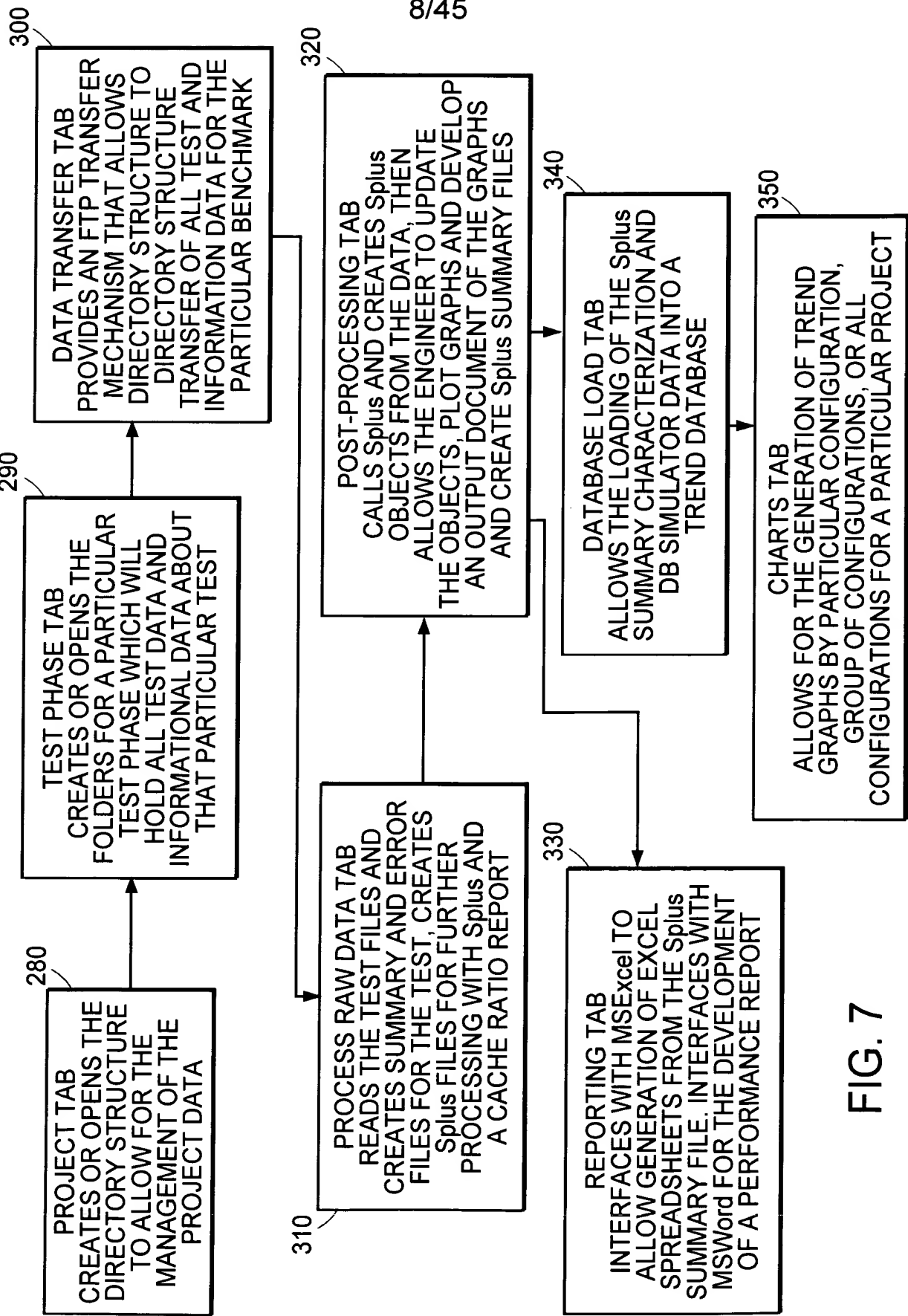
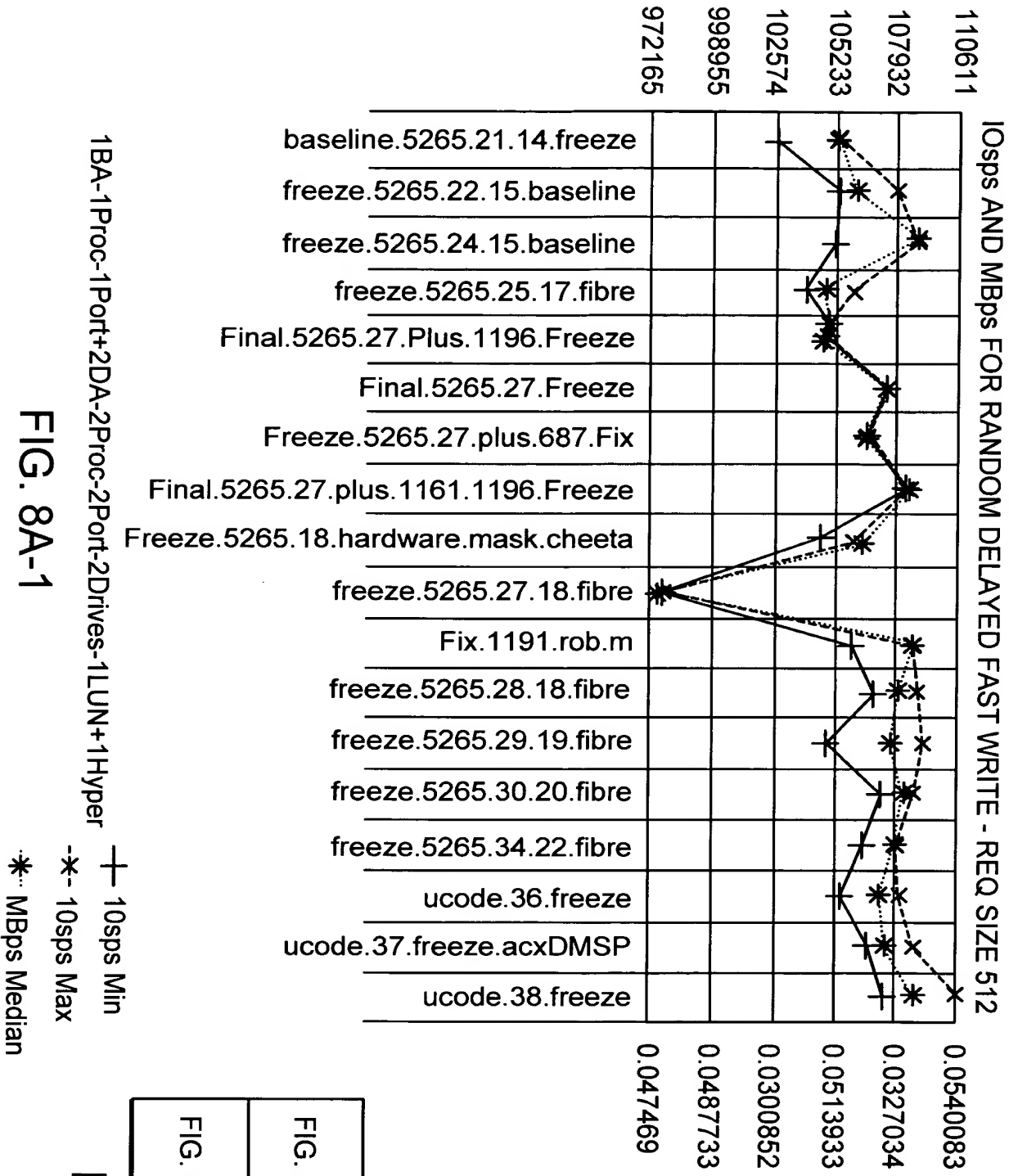


FIG. 7



1BA-1Proc-1Port+2DA-2Proc-2Port-2Drives-1LUN+1Hyper

FIG. 8A-1

+ 10sps Min  
 -x- 10sps Max  
 \* MBps Median

FIG. 8A-1	FIG. 8A-2
FIG. 8A-3	FIG. 8A-4

FIG. 8A

IOsps AND MBps FOR RANDOM DELAYED FAST WRITE - REQ SIZE 32768

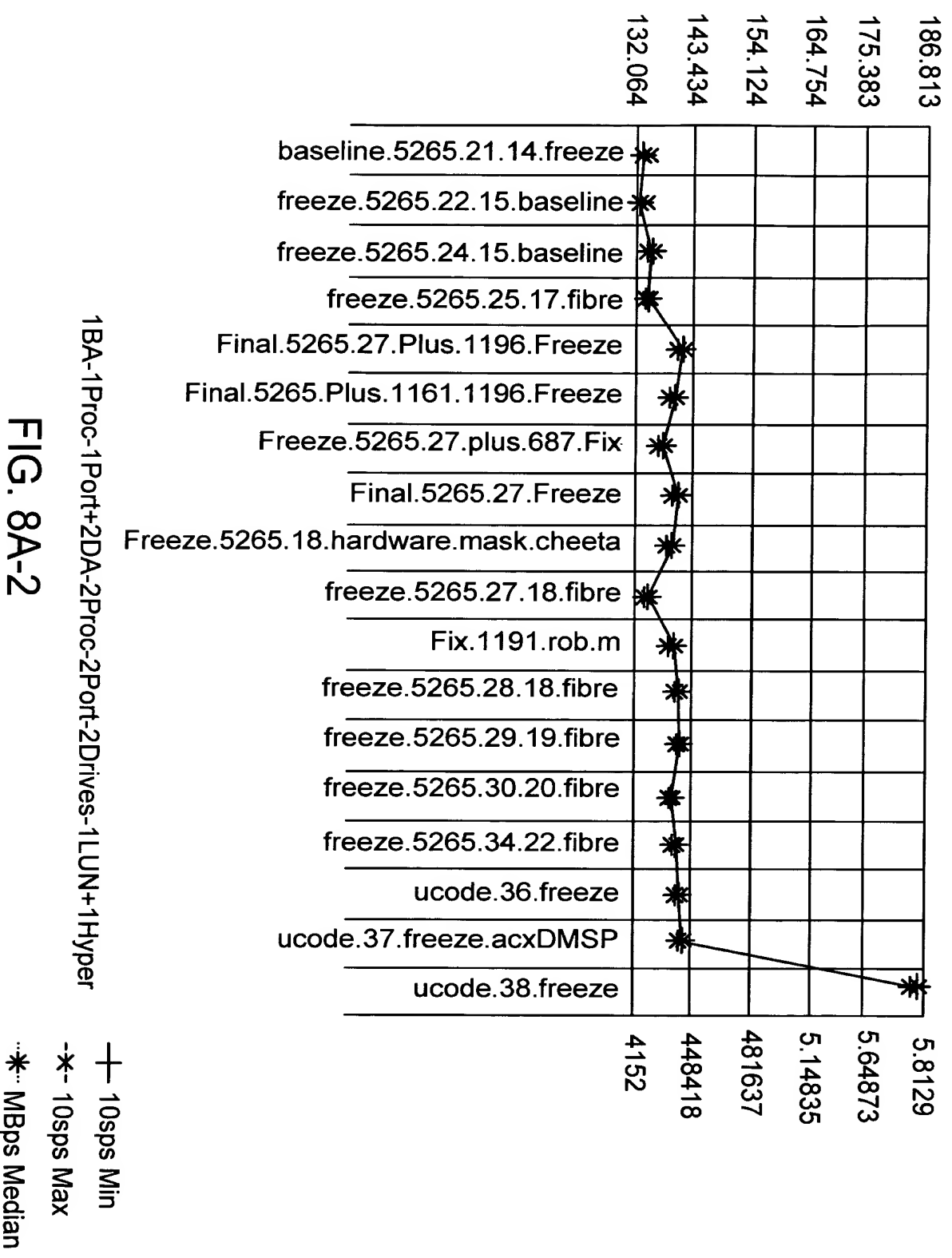


FIG. 8A-2

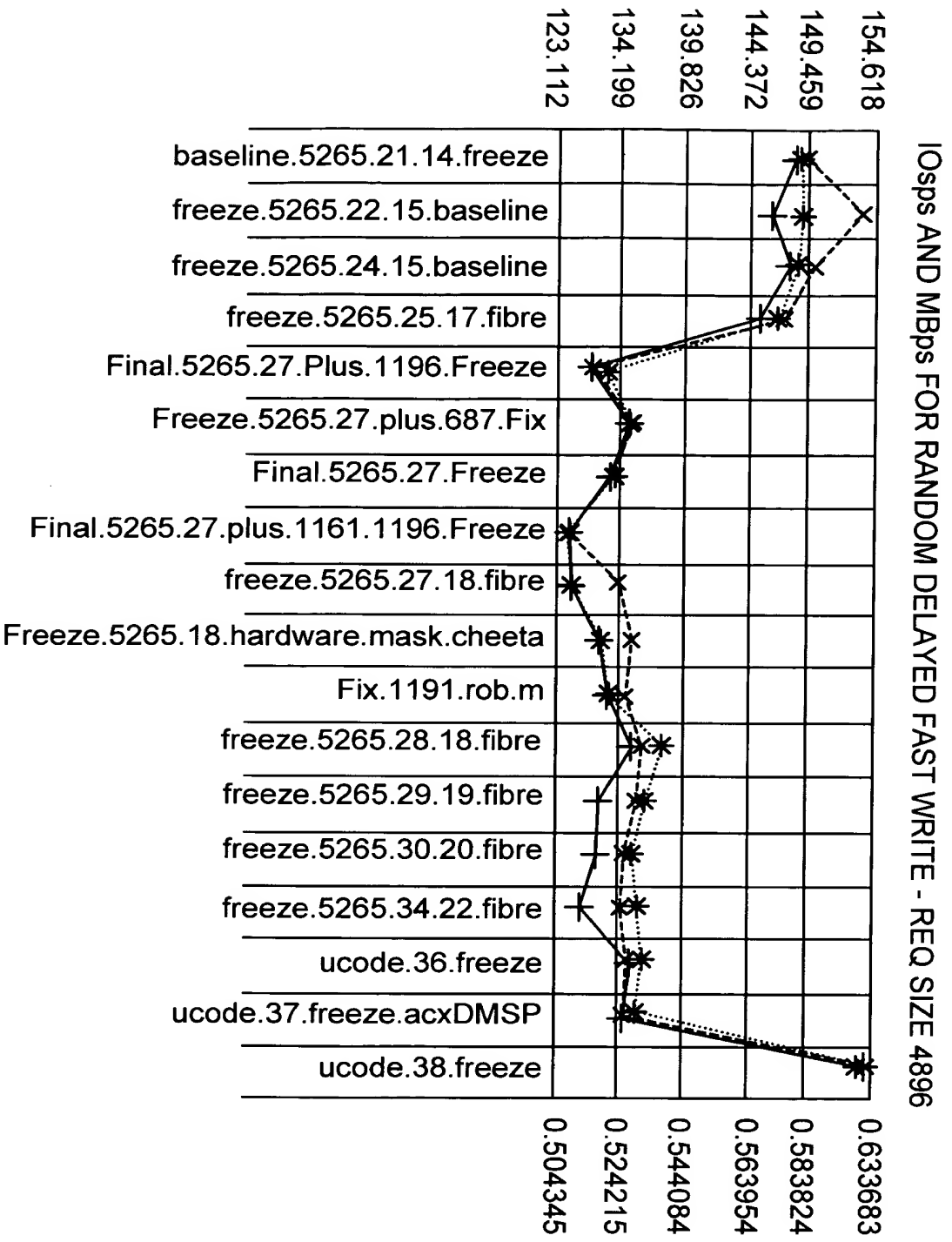


FIG. 8A-3

1BA-1Proc-1Port+2DA-2Proc-2Port-2Drives-1LUN+1Hyper

+ 10sps Min  
- \* - 10sps Max  
\* MBps Median

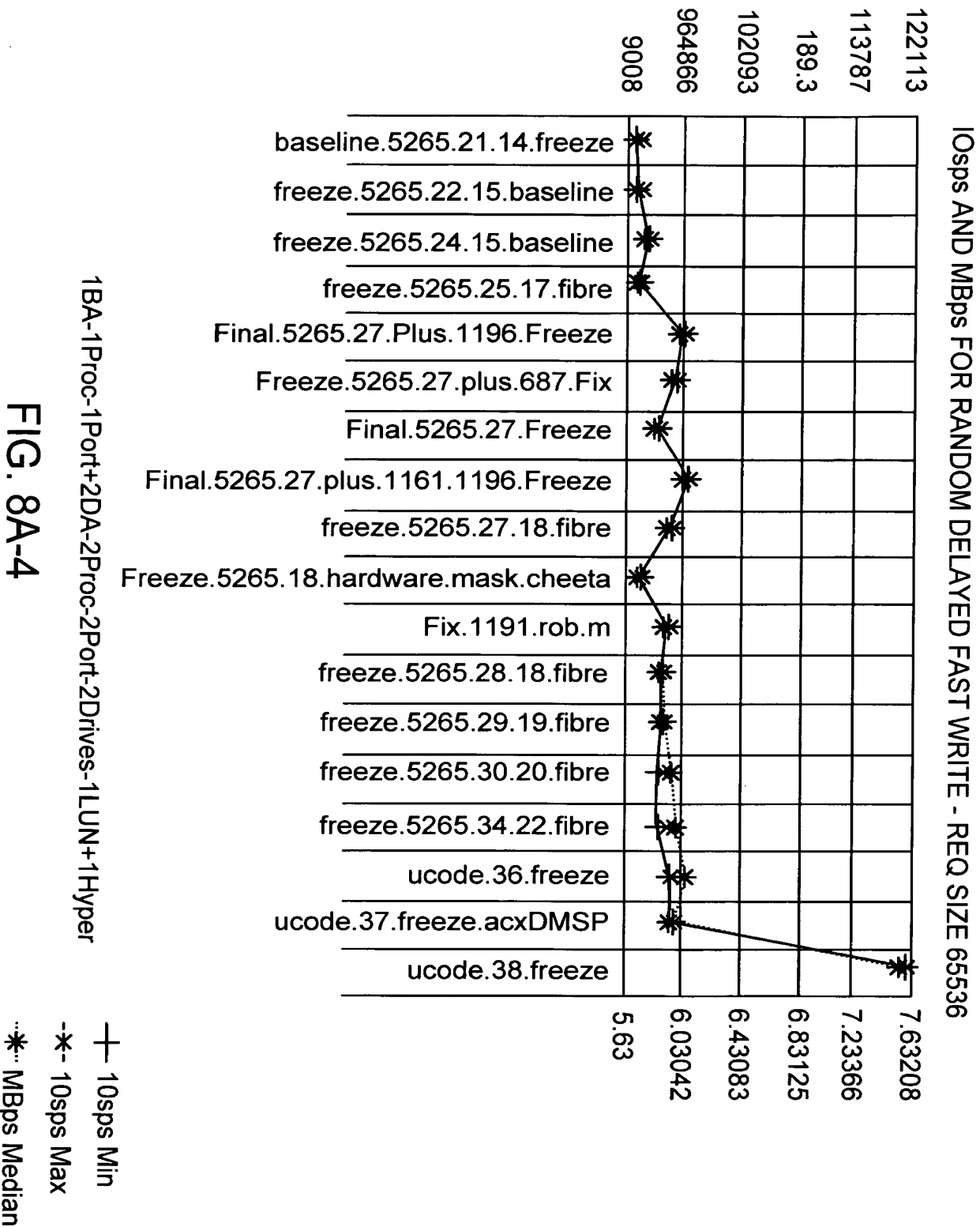


FIG. 8A-4

IOsps AND MBps FOR RANDOM DELAYED FAST WRITE - REQ SIZE 512

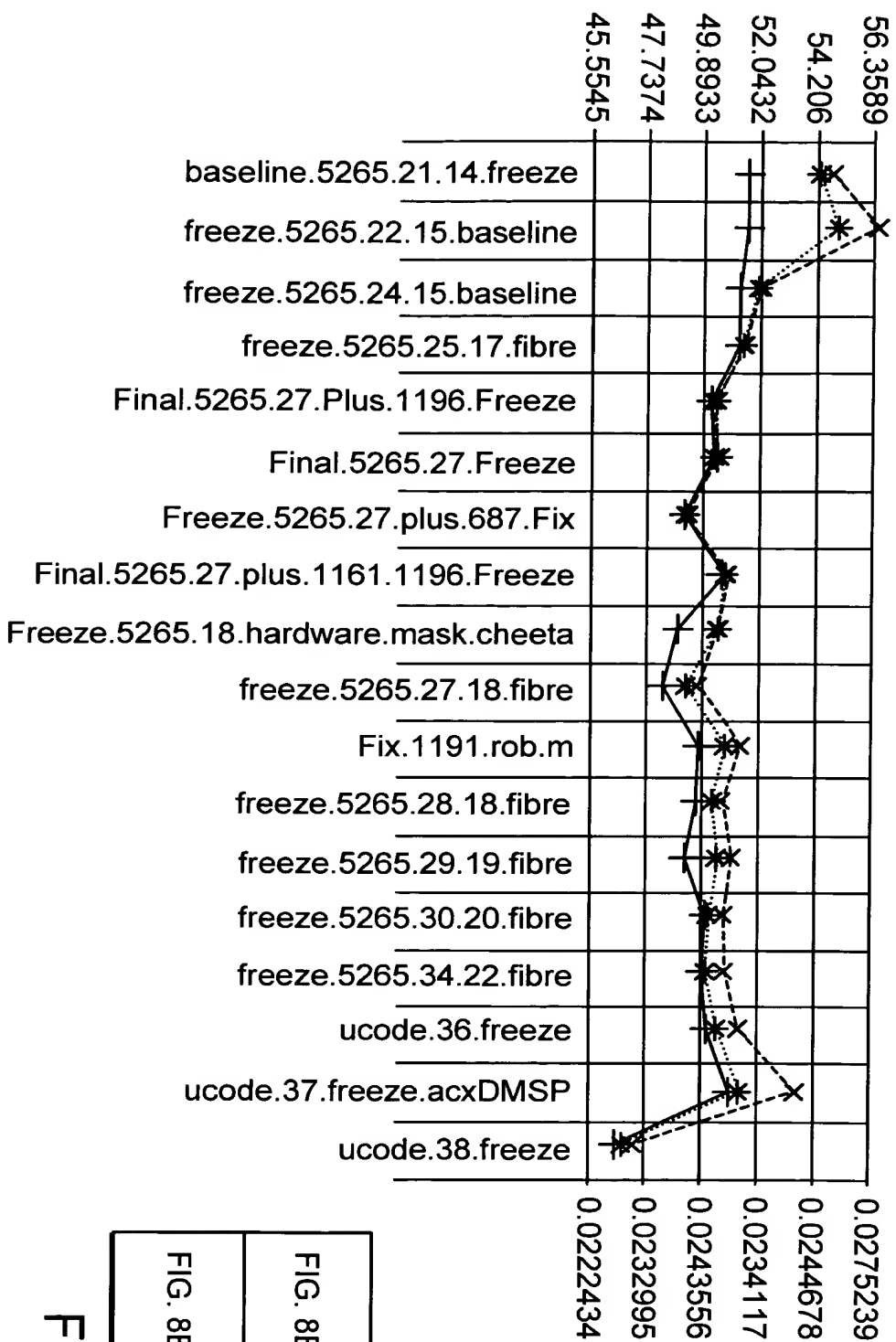


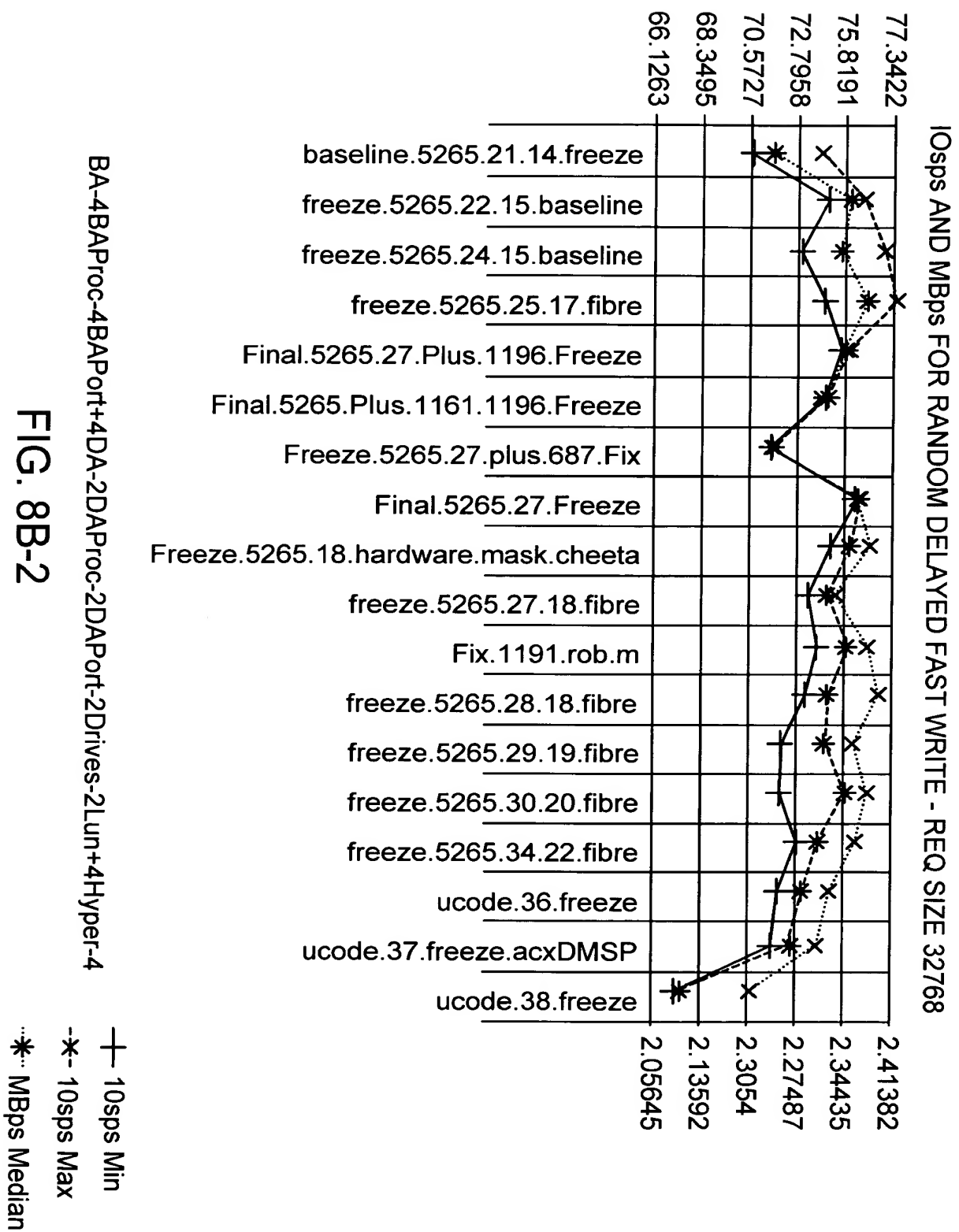
FIG. 8B-1	FIG. 8B-2
FIG. 8B-3	FIG. 8B-4

FIG. 8B

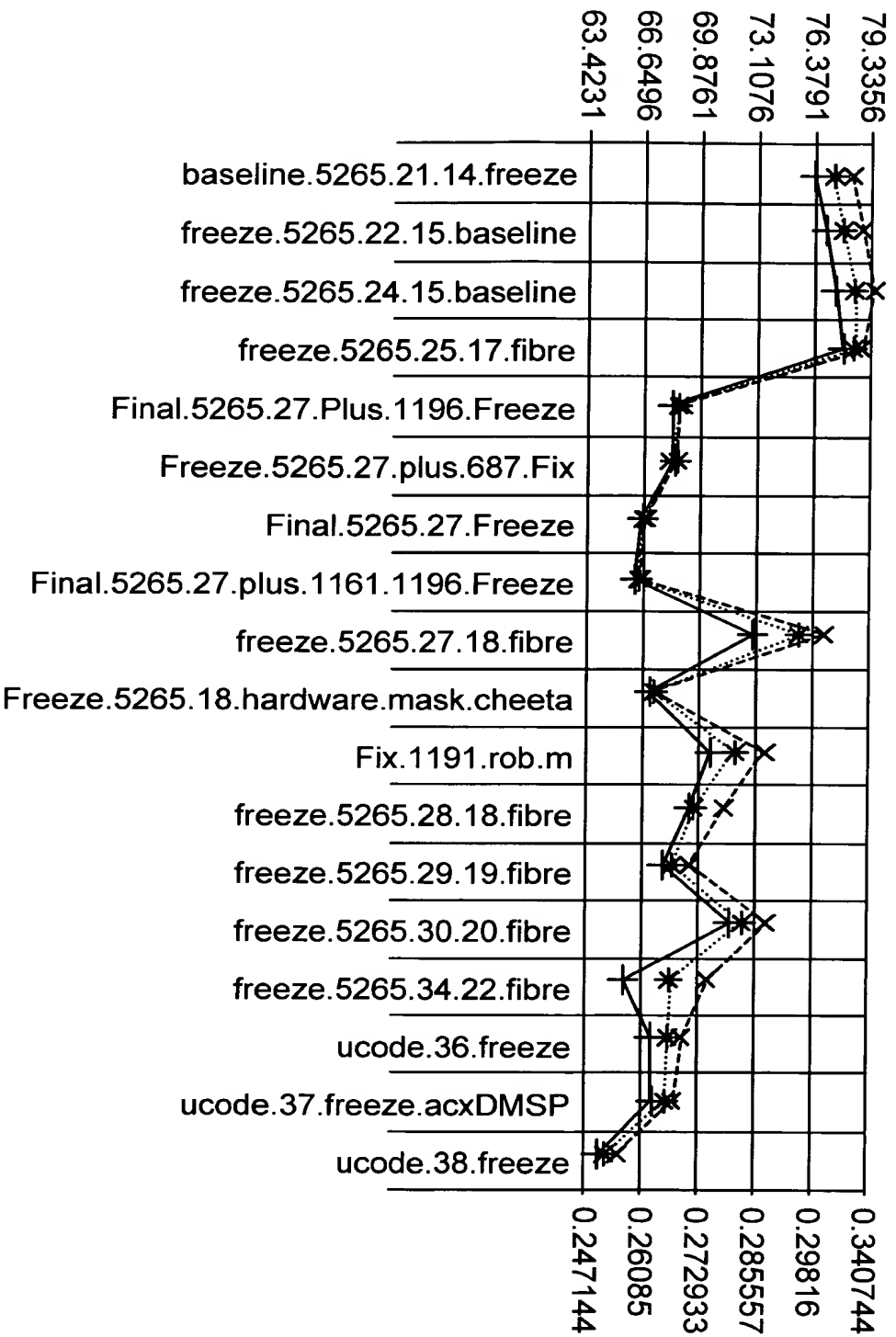
BA-4BAProc-4BAPort+4DA-2DAProc-2DAPort-2Drives-2Lun+4Hyper-4

FIG. 8B-1

- + 10sps Min
- \* 10sps Max
- ..\* MBps Median



# IOsps AND MBps FOR RANDOM DELAYED FAST WRITE - REQ SIZE 4096

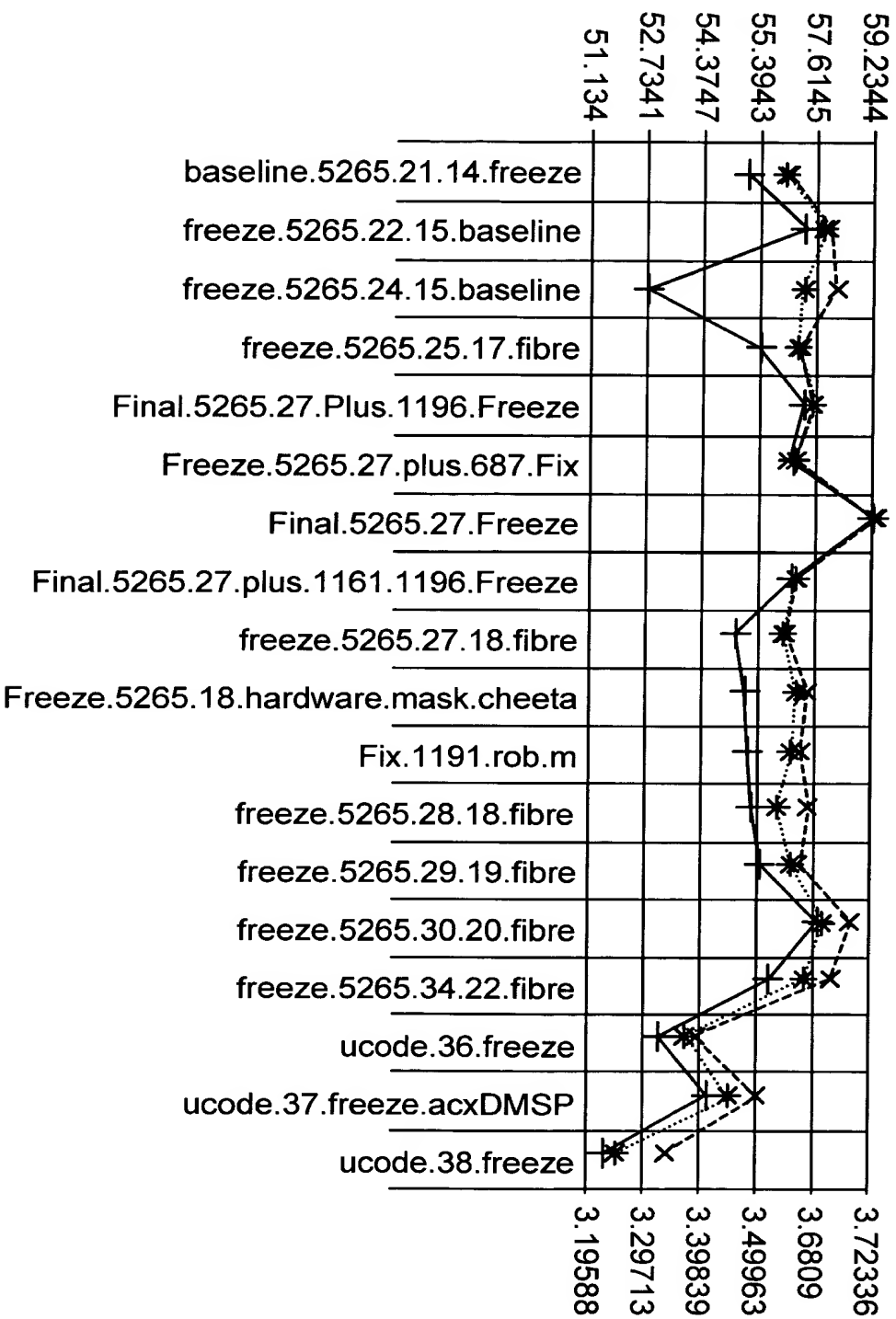


BA-4BAProc-4BAPort+4DA-2DAProc-2DAPort-2Drives-2Lun+4Hyper-4

FIG. 8B-3

+ 10sps Min  
-x- 10sps Max  
... \* MBps Median

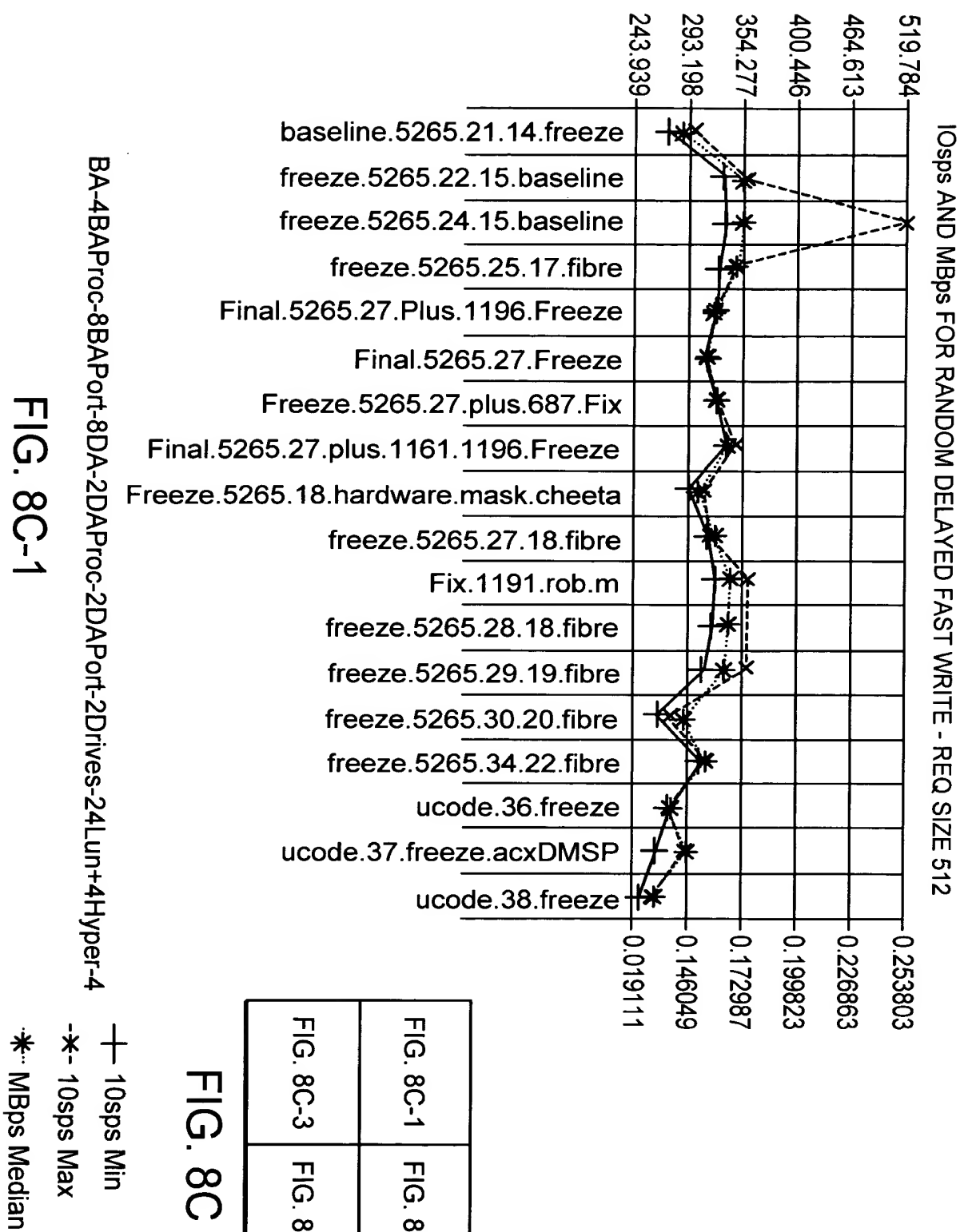
# IOsps AND MBps FOR RANDOM DELAYED FAST WRITE - REQ SIZE 65536



BA-4BAProc-4BAPort+4DA-2DAProc-2DAPort-2Drives-2Lun+4Hyper-4

FIG. 8B-4

+ 10sps Min  
 -x- 10sps Max  
 ...\* MBps Median



BA-4BAProc-8BAPort-8DA-2DAProc-2DAPort-2Drives-24Lun+4Hyper-4

**FIG. 8C-1**

+ 10sps Min  
 \* 10sps Max  
 \* MBps Median

FIG. 8C-1	FIG. 8C-2
FIG. 8C-3	FIG. 8C-4

**FIG. 8C**

# IOsps AND MBps FOR RANDOM DELAYED FAST WRITE - REQ SIZE 32768

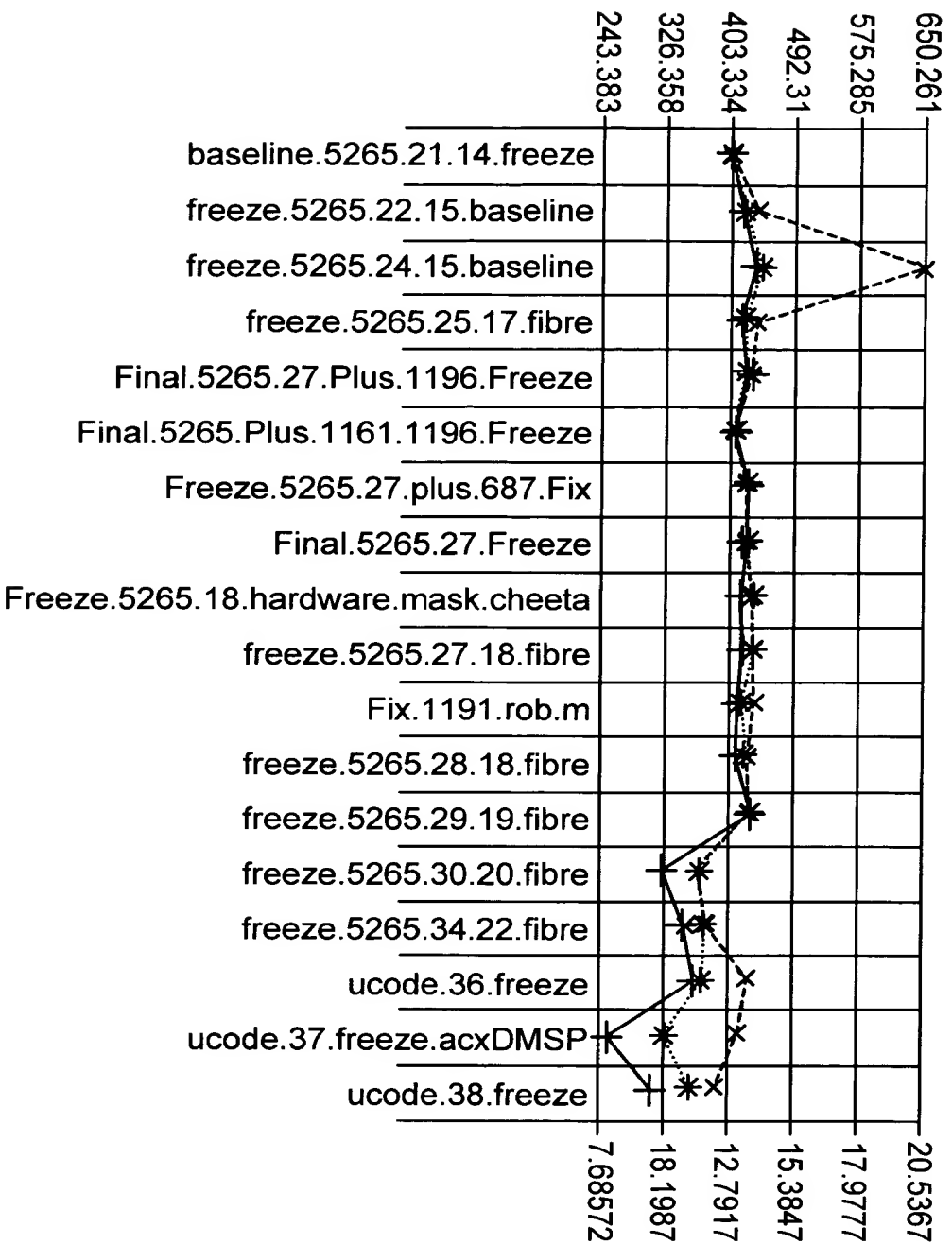
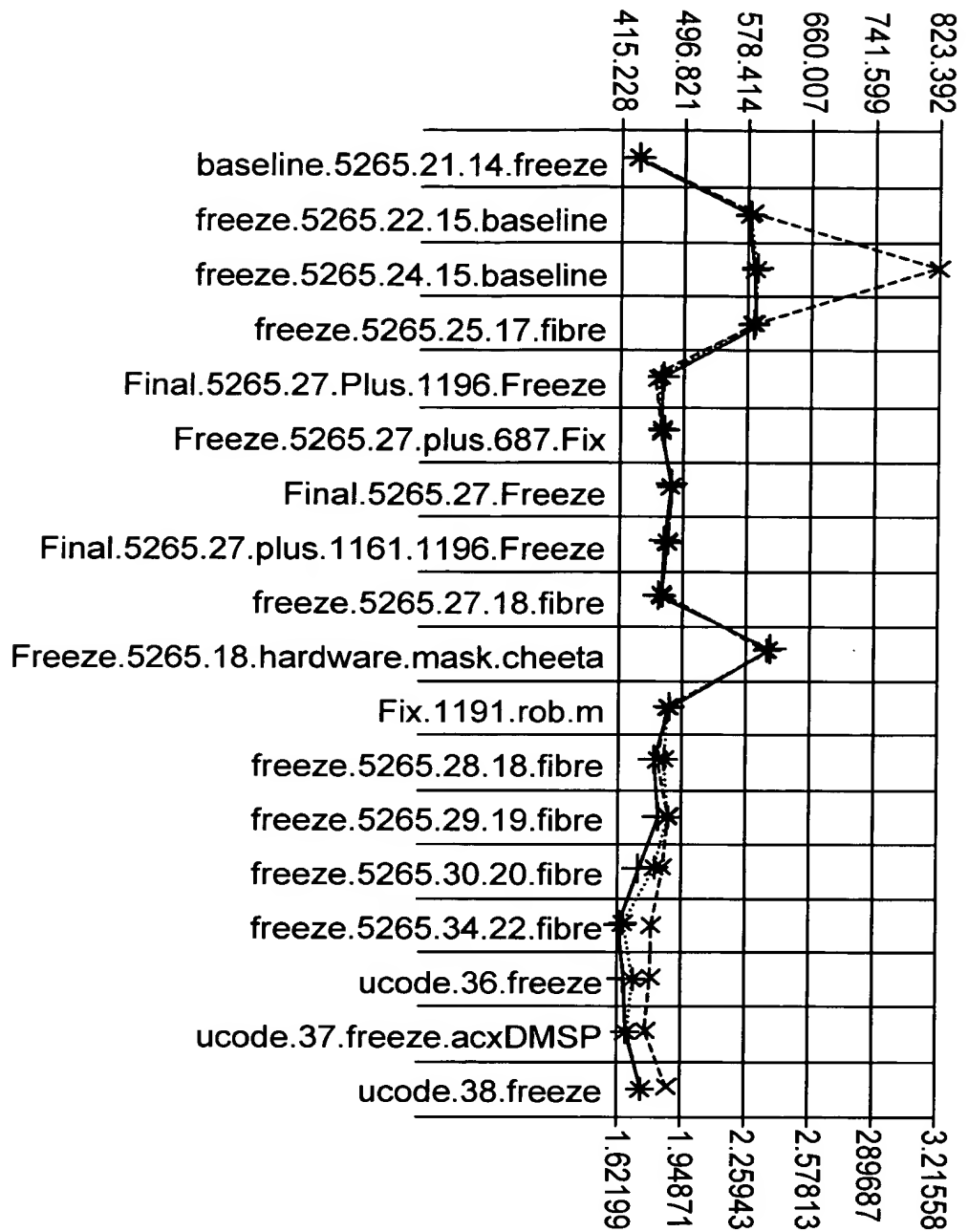


FIG. 8C-2

+ 10sps Min  
 - \* 10sps Max  
 . \* MBps Median

# IOsps AND MBps FOR RANDOM DELAYED FAST WRITE - REQ SIZE 4896

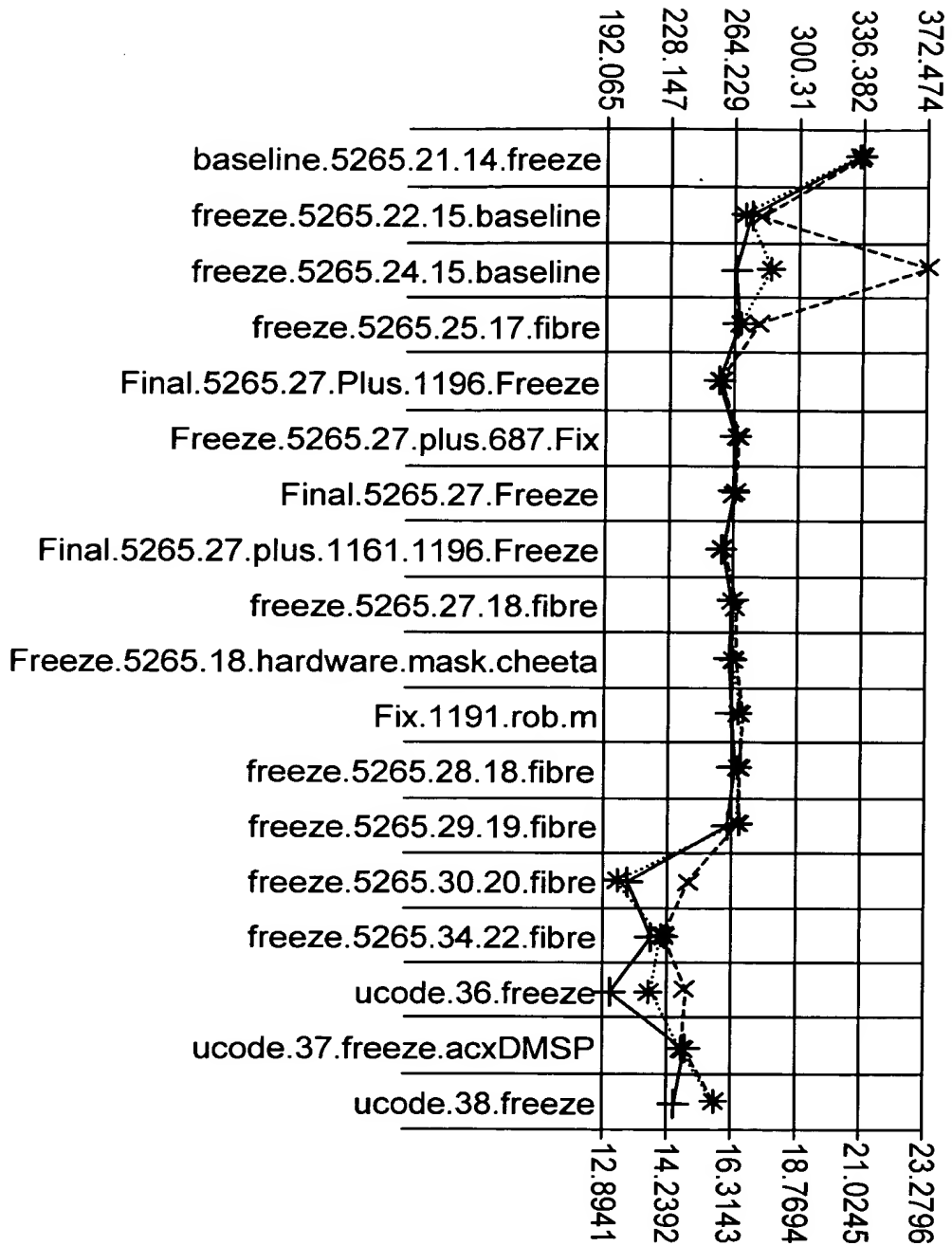


BA-4BAProc-8BAPort-8DA-2DAProc-2DAPort-2Dives-24Lun+4Hyper-4

**FIG. 8C-3**

+ 10sps Min  
 -x- 10sps Max  
 ...x... MBps Median

# IOsps AND MBps FOR RANDOM DELAYED FAST WRITE - REQ SIZE 65536



BA-4BAProc-8BAPort-8DA-2DAPProc-2DAPort-2Drives-24Lun+4Hyper-4

FIG. 8C-4

+ 10sps Min  
 -x- 10sps Max  
 ...\* MBps Median

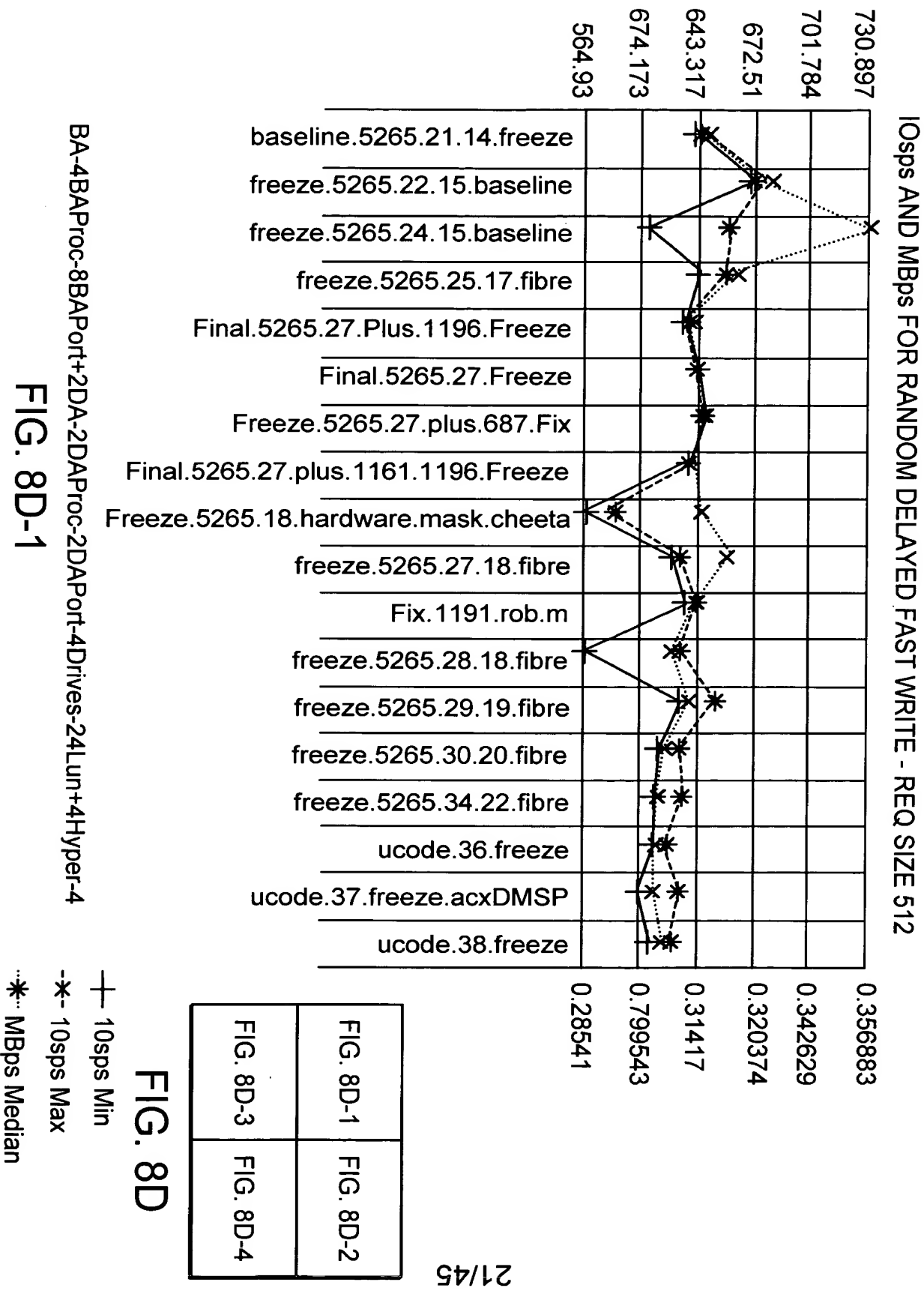
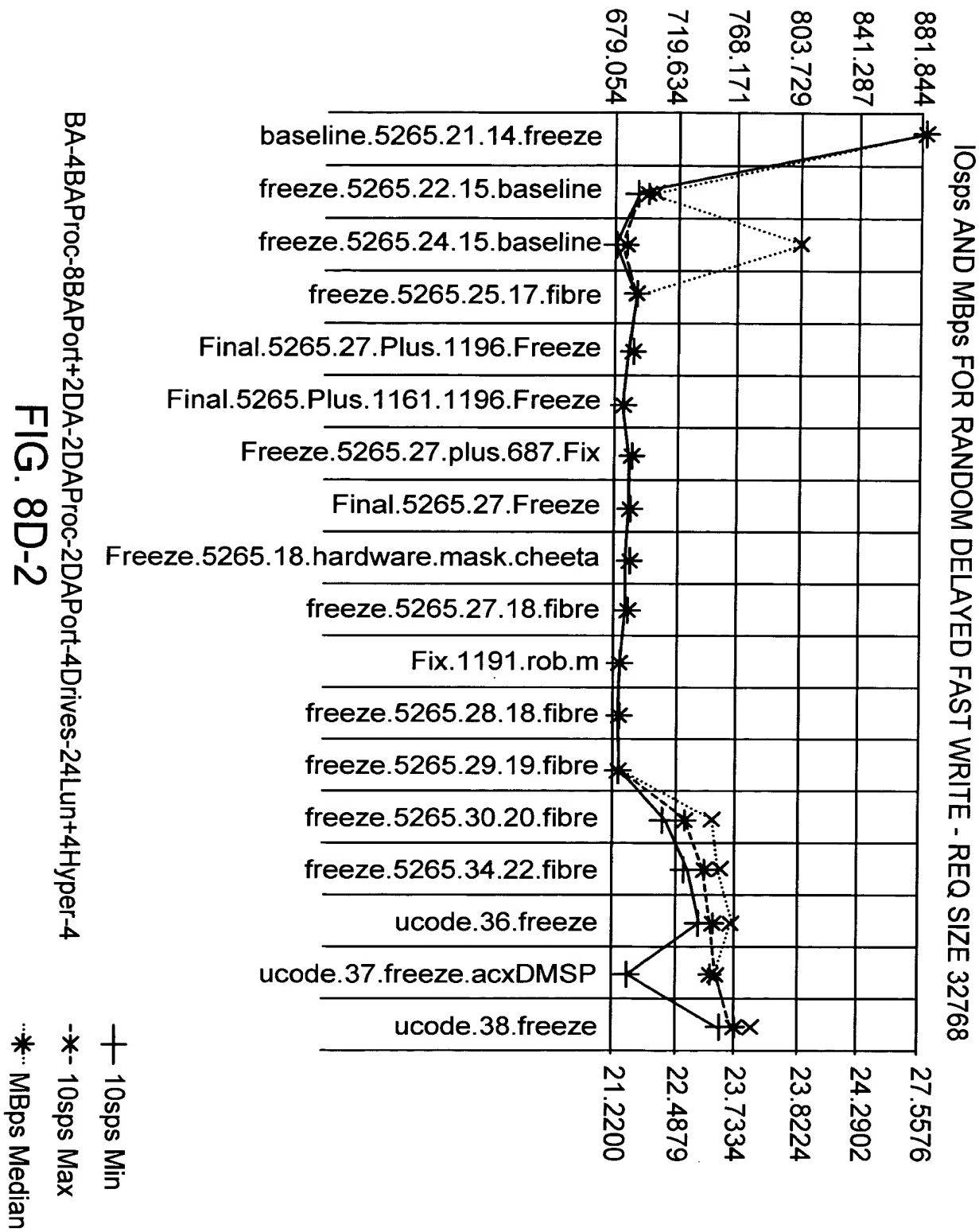


FIG. 8D-1	FIG. 8D-2
FIG. 8D-3	FIG. 8D-4



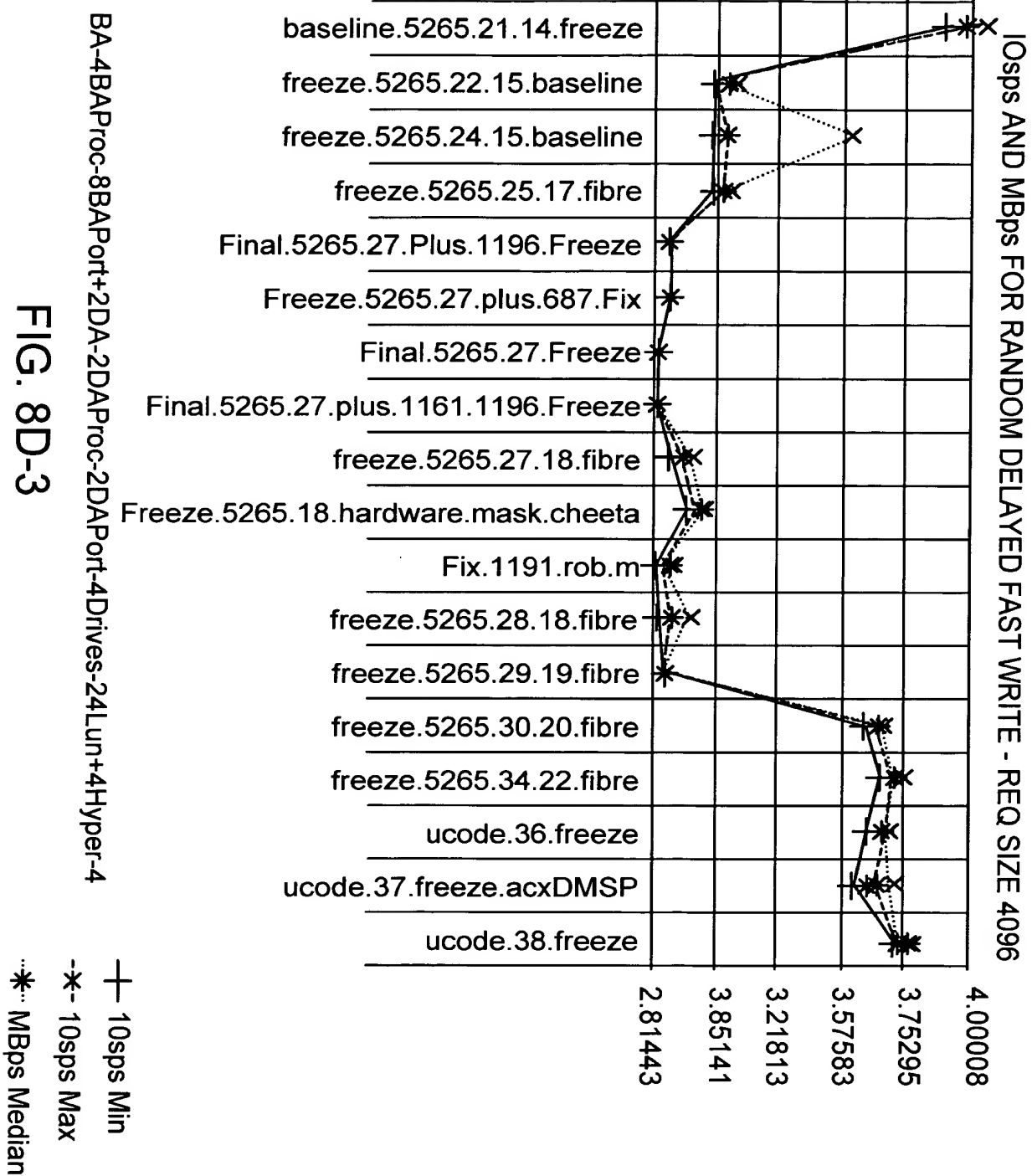
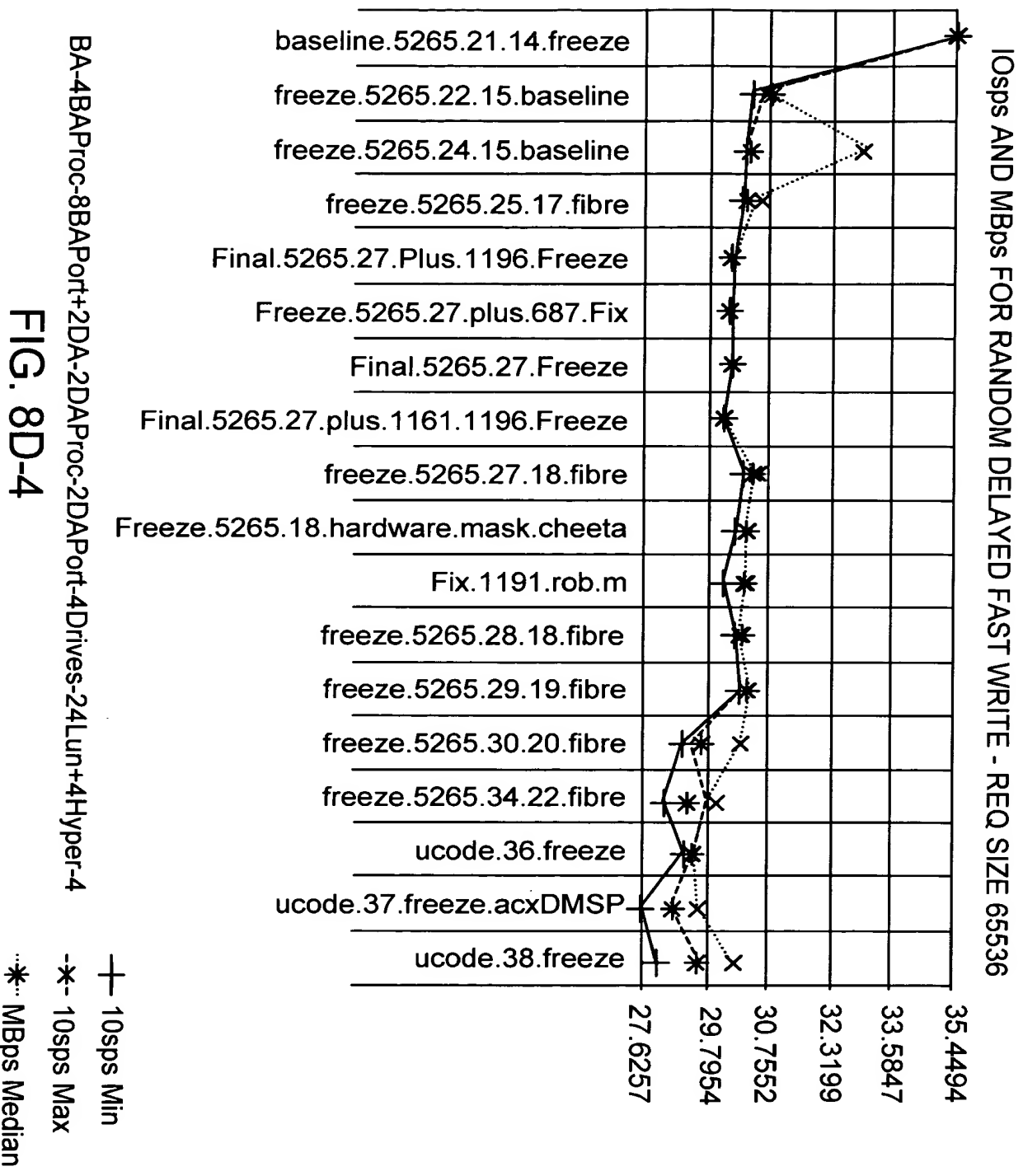


FIG. 8D-3

BA-4BAProc-8BAPort+2DA-2DAProc-2DAPort-4Drives-24Lun+4Hyper-4



POST PROCESSING TAB  
THE POST PROCESSING TAB CREATES OBJECTS, PLOT GRAPHS AND GENERATES SUMMARY  
FILES USING THE Splus DATA ANALYSIS SOFTWARE.

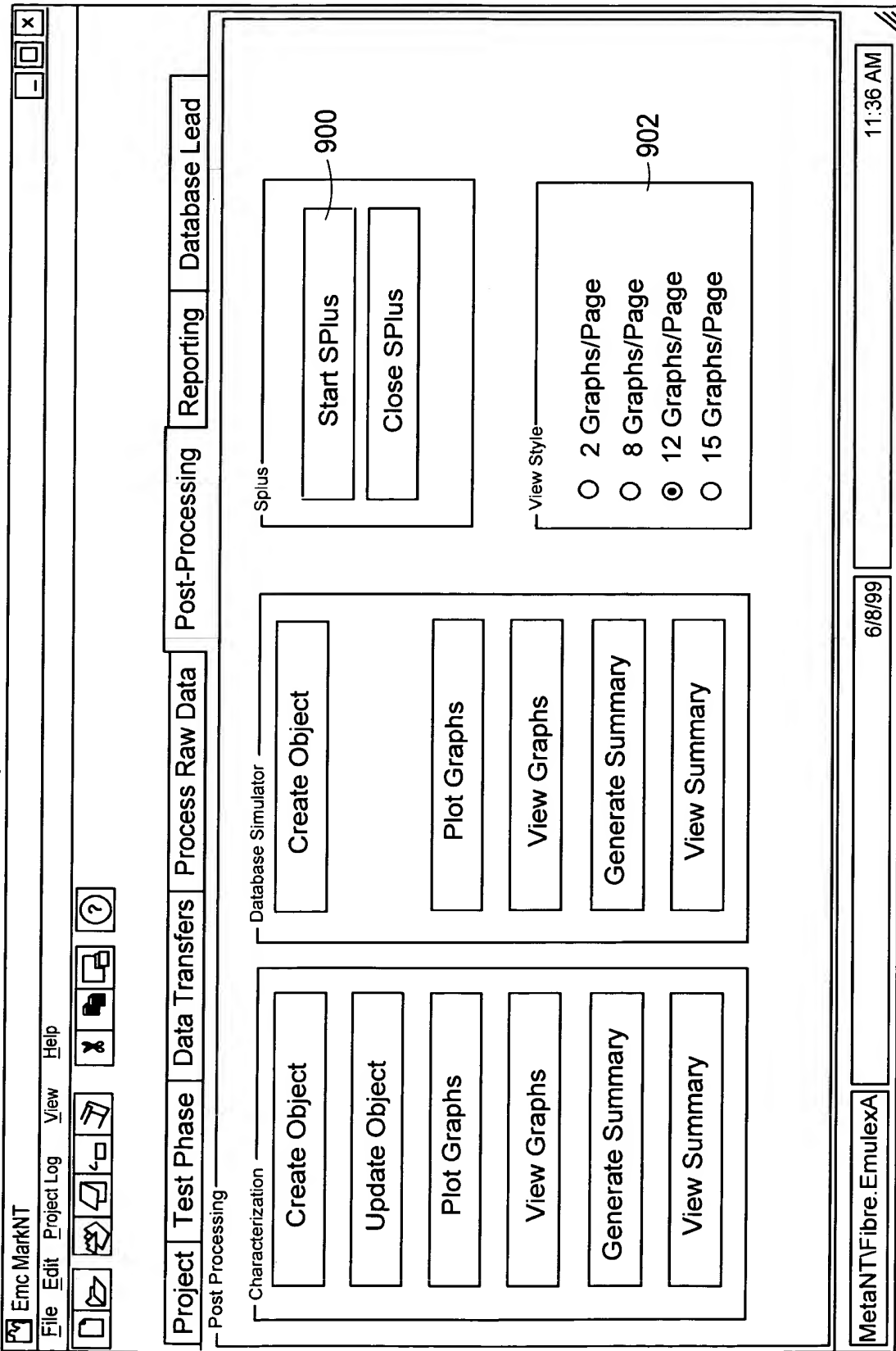


FIG. 9

SYMMETRIX CONFIGURATION VIEW

Emc MarkNT Performance Characterization W

File Actions View Help

Symmetrix Configuration

Physical Device Symmetrix Device

CPQ01 000183500055

CPQ02 000183500055

Hostname CPQ01

Add Remove Refresh

Emc MarkNT Performance Characterization W

File Actions View Help

Symmetrix Configuration

Physical Device Symmetrix Device

CPQ02 000183500055

FA-1A DA-2A DA-3A FA-5A FA-12A DA-14A DA-15A SA-16A FA-1B DA-2B DA-3B FA-5B FA-12B

Hostname CPQ01

Add Remove Refresh

Emc MarkNT Performance Characterization W

File Actions View Help

Symmetrix Configuration

Physical Device Symmetrix Device

DA-2B DA-3B FA-5B FA-12B DA-14B DA-15B SA-16B

IPHYSCALDR IPHYSCALDR IPHYSCALDR IPHYSCALDR IPHYSCALDR IPHYSCALDR

Hostname CPQ01

Add Remove Refresh

FIG. 9A

# DEVICE DETAIL

Device Details	
Symmetrix	
Vendor Id:	EMC
Product Id:	SYMMETRIX
Symmetrix Id:	000183500055
Director:	SA-16B
Port Number:	1
TID:	0
LUN:	0
Hyper Count:	2
Device Detail	
Symmetrix Device:	000
Physical Device:	\\.\PHYSICALDRIVE0
Logical Device:	
Serial Number:	55000321
Device Status:	Ready
Block Size:	512
Capacity:	7741440
Cylinders:	8064
Emulation:	FBA
Mirror Policy:	two-way mirror
Flags	
<input type="checkbox"/> CKD	<input checked="" type="checkbox"/> META Head
<input type="checkbox"/> ASSOC	<input type="checkbox"/> META Member
<input type="checkbox"/> VCM	<input type="checkbox"/> Gatekeeper
<input type="checkbox"/> Mixed	<input type="checkbox"/> Multichannel
<input type="checkbox"/> PowerPath Parent	<input type="checkbox"/> RDF
<input type="checkbox"/> PowerPath Child	<input type="checkbox"/> BCS
<input type="checkbox"/> PowerPath Sibling	<input type="checkbox"/> BCV
<input type="checkbox"/> No channel	<input checked="" type="checkbox"/> META
OK	

FIG. 9B

SYMMETRIX DETAILS

Director Details

Symmetrix

Director:	FA-1A	Num Ports:	1
Director Type:	Fibre Adapter	Port 0 status:	On
Director Num:	1	Port 1 status:	N/A
Slot Num:	1	Port 2 status:	N/A
SCIS Width:	N/A	Port 3 status:	N/A

OK

FIG. 9C



## ENVIRONMENT TAB

Emc MarkNT Performance Characterization Workbench

File Actions View Help

**Symmetrix Configuration**

☒ Physical Device ☐ Symmetrix Device

cpq01

000183500055

Hostname: cpq01

Add Remove Refresh

Definition Environment Workload Configuration Benchmark Results

Environment

Master Host Directories

Tools Directory: /bench/EMCtools

Work Directory: /bench/work

Gateway:

Flags

DMSF

☒ Auto ☐ On ☐ Off ☐ Ignore

Trace

☒ Ignore ☐ Stop ☐ Clear ☐ CKD

☒ Flush Cache

☒ IMPL Reset (\$FDCE)

Defaults

Maximum Block Size 128 k

Block Sizes

☒ 512 ☐ 1024 ☐ 2048 ☐ 4096 ☐ 8192 ☐ 16384

FIG. 9E

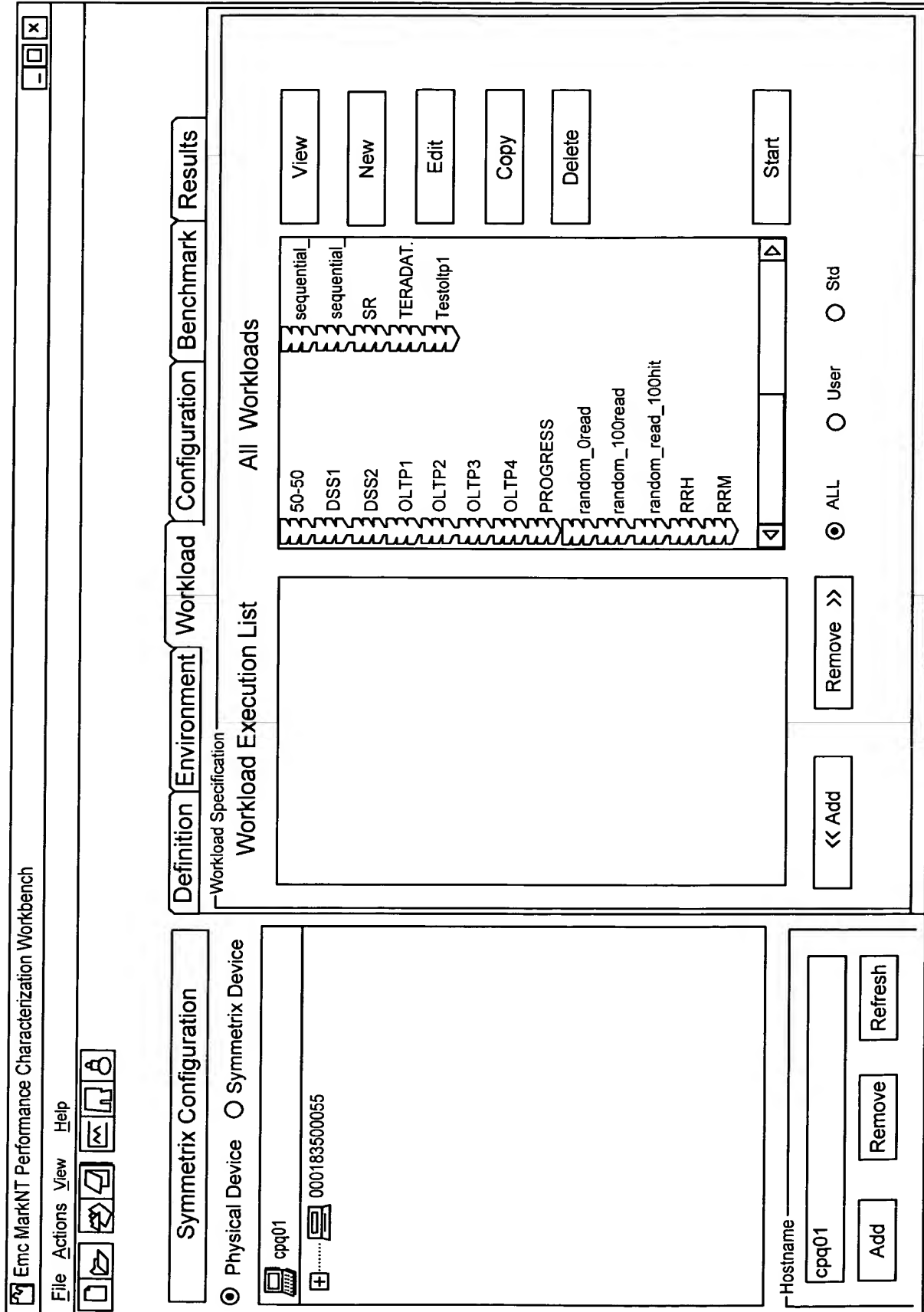


FIG. 9F

Workload Execution

Workloads

OLTP1

Configuration Rule

1BA-1Port/Proc

Iterations:

1

☐ Dry

☐ Run

OK

Cancel

FIG. 9G

RESPONSE TIME WORKLOAD

Testoltp1

Delay

1

Cache Slots

15

Max I/O Second

Auto

Bucket Size

30

Max Test Period

2:10

Min Test Period

0

Segment 1

1

Segment 2

3

Multiplier

1

LSeeks

0

Start Byte

0

Disk Extent

0

OK

Cancel

Max Sequential Count

50

Min Sequential Count

50

Response Time

☒

Throughput

☐

Workload Transaction Definition

Size	%Workload	%Hits	%Random	%Read	Align	Align Back
OMB 4KB 0B	50	0	100	100	OMB 5KB 0B	OMB 0KB
OMB 4KB 0B	30	0	100	0	OMB 3KB 0B	OMB 0KB
OMB 4KB 0B	10	0	0	100	OMB 5KB 0B	OMB 0KB
OMB 4KB 0B	10	0	0	0	OMB 3KB 0B	OMB 0KB

Request Size

0

4

MBytes

KBytes

Bytes

Alignment

0

5

MBytes

KBytes

Bytes

Back Alignment

0

0

MBytes

KBytes

Bytes

Insert

Remove

% of Workload

50

% Cache Miss/Hit

0

% Sequential/Random

100

% Write/Read

0

FIG. 9H

# THROUGHPUT WORKLOAD

View Workload

Workload Description

random\_100read

Delay

1.0

Cache Slots

0

SPIus Type

RT Size

20000

Duration Time

30

Unfrictd

0

RT Multiplier

4

I/O Loops

0

Multiplier

4

LSeeks

0

Start Byte

0

Random Range

0

Collect Response Times

Report Individual Response Times

OK

Cancel

Workload Transaction Definition

Size	% Workload	% Hits	% Random	% Read	Align	Align Back
0 MB 0KB 0B	100	0	100	100	0 MB 0KB 0B	0 MB 0KB

Request Size

0 MB 0KB 0B

Alignment

0 MB 0KB 0B

Back Alignment

0 MB 0KB 0B

Insert

Remove

% of Workload

100

% Cache Miss/Hit

100

% Sequential/Random

0

% Write/Read

0

FIG. 9J

Configuration Definition

Rule Name

OK

Cancel

Rule Definition

F/E Expression

~Expression not yet Defined

F/E Expression

B/E Expression

Front-End

☒ FA-01:a:0

☒ SA-16:a:0

☒ FA-05:a:0

☒ SA-16:a:1

☒ FA-12:a:0

☒ FA-01:a:0

AllNone

Back-End

☒ DA-02:a:C

☒ DA-15:a:C

☒ DA-03:a:C

☒ DA-02:a:C

☒ DA-14:a:C

☒ DA-03:a:C

AllNone

Expressions

Build

Update

Max I/O Second

Auto

Mirrors

☒ M1

☐ M2

AllNone

TIDS

☒ 0

☐ 1

AllNone

LUNs

☒ 0

☒ 1

☒ 2

☒ 3

AllNone

FIG. 9K

Emc MarkNT Performance Characterization Workbench

File Actions View Help

Symmetrix Configuration

☒ Physical Device    ☐ Symmetrix Device

cpq01  
 000183500055

Hostname: cpq01  
 Add Remove Refresh

Definition Environment Workload Configuration Benchmark Results

Benchmark Definition

Benchmark Execution List

All Benchmarks

Profiling  
 Regression

View  
 New  
 Edit  
 Copy  
 Delete

Start

<< Add    Remove >>    ☒ ALL    ☐ User    ☐ Std

FIG. 9L

Benchmark Execution

Benchmark

Regression

Iterations: 3

☐ Dry Run

FIG. 9M

View Benchmark

Benchmark Name

Regression

OK

Cancel

Benchmark Workload Definition

Workload	Configuration Rule	Delay Milliseconds	CacheSlots	MaxIOPs
RRM	1Hyper	-1	-1	
RRM	Everything	-1	-1	
OLTP1	Everything	-1	-1	
OLTP2	3Hypers/4Drives	-1	-1	
OLTP3	1Hyper/2Drives	-1	-1	
DSS1	1Hyper	-1	-1	
DSS2	Everything	-1	-1	
TERADATA	2Drives/DA-3Hyper/4Drives	-1	-1	

Delay

0

Cache Slots

0

Max I/O Second

0

Bucket Size

0

Max Sequential Count

50

Max Test Period

0

Min Test Period

0

Segment 1

0

Segment 2

0

Min Sequential Count

50

Multiplier

0

LSeeks

0

Start Byte

0

Disk Extent

0

Workload

RRM

Configuration Rule

1 Hyper

Insert

Remove

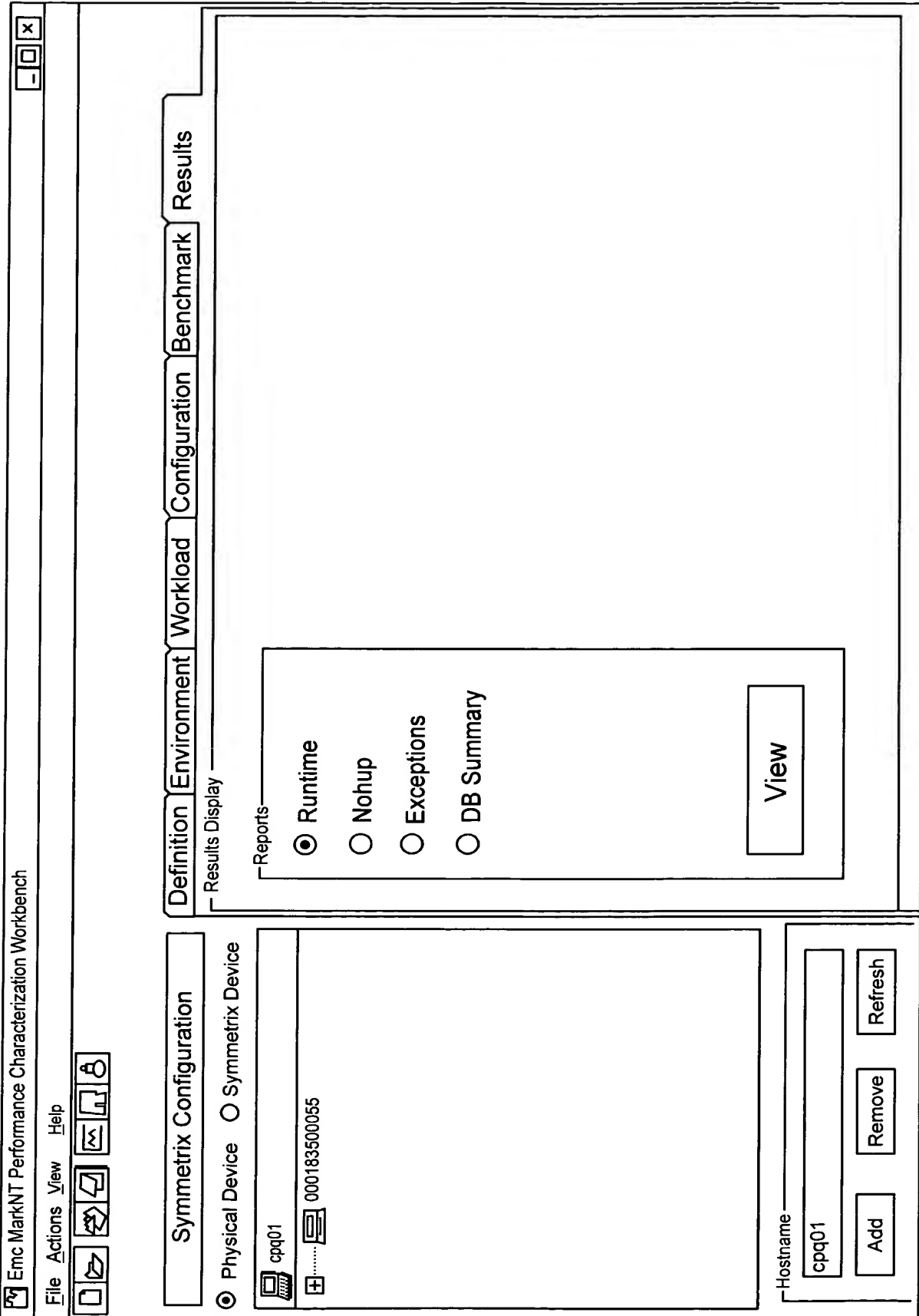


FIG. 90

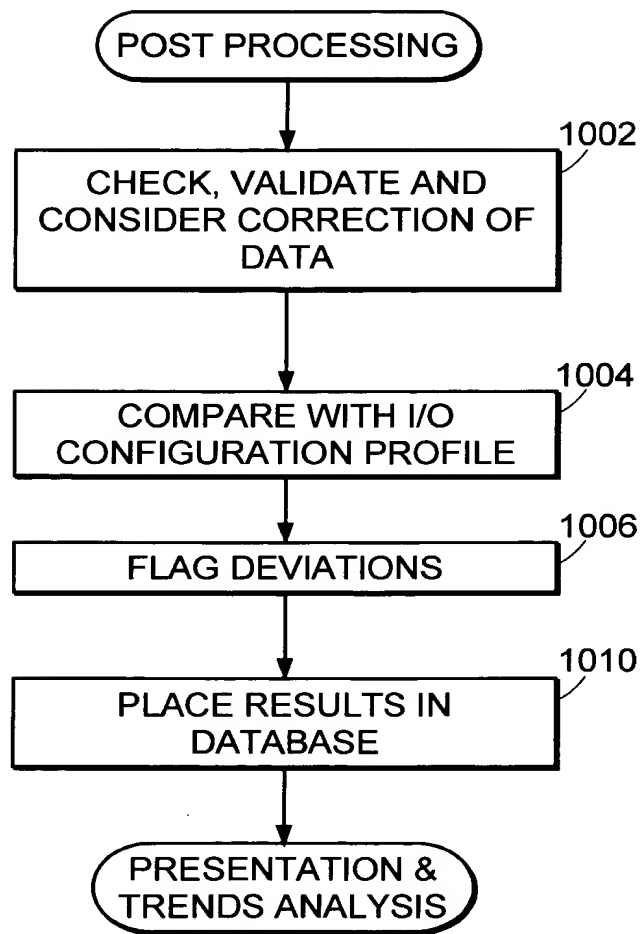


FIG. 10



FILE DESCRIPTIONS

FILE NAME	DESCRIPTION	HIGHLIGHTS
Char.Summary	SUMMARY FILE OF EACH CHARACTERIZATION TEST BROKEN DOWN BY ITERATION, TEST TYPE, AND CONFIGURATION	
Char.Splus	DATA FILE FEED TO Splus TO CREATE CHARACTERIZATION OBJECTS	
Char.Errors	CHARACTERIZATION ERRORS PRODUCED FROM PROCESSING THE RAW DATA FILES.	MESSAGE APPEARS IF ERROR FILE EXISTS
SX.Summary	SX SUMMARY DATA BROKEN DOWN BY ITERATION, TEST TYPE AND CONFIGURATION	
SX.Splus	DATA FILE FEED TO Splus: USED WITH Char.Summary FILE TO CREATE CHARACTERIZATION OBJECTS	
SX.Errors	SX ERRORS FROM PROCESSING THE RAW DATA FILES	MESSAGE APPEARS IF ERROR FILE EXISTS

FIG. 11A

DB.Table	SUMMARY FILE OF EACH DB SIMULATOR TEST BROKEN DOWN BY ITERATION, TEST TYPE AND CONFIGURATION		
DB.Splus	DATA FILE FEED TO Splus TO CREATE DBSimulator OBJECTS		
DB.Errors	DB SIMULATOR ERRORS PRODUCED FROM PROCESSING THE RAW DATA FILES	MESSAGE APPEARS IF ERROR FILE EXISTS	
SX_DB.Summary	SX DB SUMMARY DATA BROKEN DOWN BY ITERATION, TEST TYPE AND CONFIGURATION		
SX_DB.Splus	DATA FILE FEED TO Splus. USED WITH DB.Splus FILE TO CREATE DBSimulator OBJECTS		
SX_DB.Errors	SX_DB ERRORS PRODUCED FROM PROCESSING THE RAW DATA FILES	MESSAGE APPEARS IF ERROR FILE EXISTS	
Cache Ratio Report	REPORT TRACKING THE CACHE RATIO FROM THE SYM AND THE PROCESSED DATA	REPORT NAME: "CacheRatioReport.txt" LOCATED IN THE RAW DATA FOLDER MESSAGE APPEARS IF A REPORT	

FIG. 11B

FIG. 12

FIG. 12